ISSN 2564-3843
DOI 10.26443/glsars.v1i1.150

SMART-CITY REGULATION: CHINA'S MEGACITIES AND THE TAKE-OUT FOOD WASTE PROBLEM*

Abstract

Take-out food waste has become a problem for big cities globally; the smart city is believed to be an ideal solution. Consider that around 65 million people live in Beijing, Shanghai and Shenzhen，within an area of approximately 32,000 km² as of 2019. By comparison, Canada's population in 2019 was 37.6 million and the area of Canada is approximately 10 million km². China is on the leading edge of smart-city projects because its population density gives it little choice. China must take bold steps in terms of both technology and regulation to cope with the demands for social management, which these megacities create. Many smart cities pilot projects are underway across China addressing many infrastructural and other organizational concerns. One such organizational concern is coping with the solid waste generated in cities. China produces more than 300 million tons of solid waste per year, and much of it comes from its cities. This paper explores China's food and beverage delivery online platforms and the waste they cause. In 2019, this industry developed rapidly, generating economic activity valued at ¥ 653.6 billion that year ($CAD 121 billion). Out of a total population of 1.4 billion, 460 million people are currently regular consumers of these online platforms. Most of these consumers live in China's megacities. This consumption is not projected to decrease post-pandemic; the solid waste from this industry in 2020 weighed approximately 310 million tons. This paper analyzes reasons why the online food take-out industry has caused a plastic waste surge from the perspective of China's environmental legislation, law enforcement efficiency, and recycling subsidies. At the same time, through the case study of the German Packaging Law, this paper made suggestions for the management and recycling of Chinese take-out packaging. The Chinese government has issued national standards for the design and construction of smart cities. This paper explores how to use legal governance and supervision in smart city design and operation to assist in implementing environmental regulations to control the take-out

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waste. The take-out waste problem does not only exist in China. Almost all major cities in the world are facing this problem. China's experiences may provide a new path for solid waste disposal and other environmental issues and lead the cities to explore more environmental protection possibilities.

Keywords: Smart city legislation, take-out waste, German Packaging Law, Chinese take-out waste legislation

Résumé

En 2019, 26,3 millions de personnes vivaient à Shanghai et 20 millions vivaient à Pékin. Ces 46,3 millions de personnes habitent une superficie d'environ 23 000 km². En comparaison, la population du Canada en 2019 était de 37,6 millions d'habitants et la superficie du Canada est d'environ 10 millions de km². La Chine est un chef de file en matière de villes intelligentes parce que la densité de population ne lui laisse guère le choix d'innover. La Chine doit prendre des mesures audacieuses, tant sur le plan technologique que réglementaire, pour faire face aux exigences de gestion sociale créées par ses mégapoles. En conséquence, environ la moitié des projets de villes intelligentes dans le monde se retrouvent en Chine. De nombreux projets pilotes de villes intelligentes sont en cours sur tout le territoire chinois. Ils portent sur de nombreuses infrastructures et autres préoccupations organisationnelles. L'une de ces préoccupations est la gestion des déchets solides générés dans les villes. En effet, la Chine produit plus de 300 millions de tonnes de déchets solides par an, dont une grande partie provient de ses villes. Ce projet de recherche explore les plateformes en ligne de livraison de nourriture et de boissons en Chine et les déchets qu'elles provoquent. En 2019, cette industrie s'est développée rapidement, générant une activité économique évaluée à 653,6 milliards de yens (121 milliards de dollars canadiens). Sur une population totale de 1,4 milliard d'habitants, 460 millions de personnes sont actuellement des consommateurs de ces plateformes en ligne. La plupart de ces consommateurs vivent dans l'une des mégapoles chinoises. Cette consommation ne devrait pas diminuer après la pandémie. Les déchets solides de cette industrie pesaient en 2019 environ 2,7 millions de tonnes. Cet article examine les raisons pour lesquelles l'industrie de la restauration à emporter via

des plateformes en ligne a provoqué une flambée de déchets plastiques. Cette analyse s'attarde à la législation environnementale chinoise, à l'efficacité de l'application de la loi et aux subventions pour le recyclage. Parallèlement, via une l'étude de cas de la loi allemande sur les emballages, cet article propose des suggestions sur la gestion et le recyclage des emballages des plats à emporter en Chine. Le gouvernement chinois a publié des normes nationales pour la conception et la construction de villes intelligentes. Cet article étudie comment utiliser la gouvernance et la supervision juridiques dans la conception et l'exploitation des villes intelligentes. Plus précisément, ce texte tente d'aider à la mise en œuvre des réglementations environnementales afin de contrôler les déchets à emporter. L'enjeu des déchets issus de la restauration à emporter n'existe pas seulement en Chine. Presque toutes les grandes villes du monde sont confrontées à ce problème. L'expérience chinoise peut ouvrir des pistes de solution pour l'élimination des déchets solides et d'autres questions environnementales ainsi qu'amener les villes à explorer davantage de possibilités en matière de protection de l'environnement.

Mots-clés : Législation concernant les villes intelligentes, déchets issus de l'industrie de la restauration à emporter, droit de l'emballage en Allemagne, législation chinoise sur les déchets issus de la restauration à emporter

INTRODUCTION

The rapid increase in the amount of solid waste caused by food delivery has become a global problem. Whether smart cities are the answer to the environmental governance of megacities is a popular topic. In China, this issue is particularly prominent because of the population base and economic scale. In 2017, China's population reached 1.4 billion, and China's online food delivery business generated 1.6 million tons of packaging waste, and in 2019 it reached 2.69 million tons[1]. Most disposable chopsticks and foamed lunch boxes are not even recycled; nearly

[1] <https://www.nytimes.com/2019/05/28/technology/china-food-delivery-trash.html> accessed 8 April 2021.

three-quarters of plastic waste ends up in poorly managed landfills or the ocean[2]. The Chinese Environmental law and the Solid Wastes Law both stipulate the use and the disposal of take-out meal boxes. However, these laws are too general to prevent a large amount of plastic waste from the food delivery industry.

This paper explores the feasibility of China using smart cities to manage the surge in food delivery waste. Consider that 26.3 million people live in Shanghai, 20 million live in Beijing and 13 million live in Shenzhen as of 2019[3]. Now consider that these 59.3 million people live within an area of approximately 23,000 km²[4]. By comparison, Canada's population in 2019 was 37.6 million and the area of Canada is approximately 10 million km²[5]. Out of a total Chinese population of 1.4 billion, 460 million people are currently consumers of these online platforms[6]. Most of these consumers live in China's megacities[7]. To manage such a huge environmental pressure, China started a series of constructing smart cities; about half of the smart city projects globally are in China. In other words, China is on the leading edge of smart-city projects because its population density gives it little choice[8]. China must take bold steps in terms of both technology and regulation to cope with the demands for social management, which these megacities create.

Many smart cities pilots are underway across China, addressing many infrastructures

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[2] Ibid.

[3] National Bureau of Statistics of the People's Republic of China, China Urbanization Report 2019 (2020).

[4] Ibid.

[5] <https://www150.statcan.gc.ca/n1/daily-quotidien/200929/dq200929b-eng.htm> accessed 1 May 2021.

[6] Xu Fengyi, 'New Consumption Upgrade, New Catering Home: China Catering Report', (Meituan Report, June 25 2019).

[7] Ibid 5.

[8] Yi Ou Consultant, 'Research Report on Smart City Development in China 2020' <https://pdf.dfcfw.com/pdf/H3_AP202010131421136215_1.pdf> accessed 7 Jun 2021.

and other organizational concerns. One such organizational concern is coping with the solid waste generated in cities. Since there is no national solid waste management and recycling system in China, the smart city has been considered as an effective alternative measure to manage this problem. Therefore, the way that smart cities regulate these behaviours (especially through top-level design and application levels) and the legal governance of smart cities themselves have become issues of widespread concern.

This paper first examines why China produces a large amount of take-out meal box waste and why China's current environmental laws legislations cannot manage it. It then explores the advantages of the German Packaging Ordinance, what the Chinese government could learn from it and the feasibility of a similar system in China. Next, it analyses China's existing smart city legislation and how smart cities could assist with environmental legislation and supervise and control the various variables that produce solid waste from food delivery in China. The last part of the paper provides suggestions for using smart city projects to manage the surge in take-out waste.

Urban garbage caused by take-out meal boxes is not unique to China's big cities, but a global problem; the smart city is also a global trend. The research in this paper will provide experience and reference for other countries based on China's experience in improving environmental legislation. The experience and theory of this attempt may provide a new path for urban solid waste disposal and other environmental problems for other countries, leading cities to explore an environmentally friendly and ecological future with technology.

PART 1. A BRIEF OVERVIEW OF CHINA'S TAKE-OUT GARBAGE AND RELATED ENVIRONMENTAL LEGISLATIONS

The surge of Chinese take-out garbage and its social reasons China's Internet food delivery

industry has experienced explosive growth in recent years. Of China's 1.4 billion population, 460 million people have become users of Internet food delivery platforms[9]. In the first half of 2019, China's internet food delivery industry scale was approximately ¥ 262.5 billion that year [10] ($CAD 52 billion). More than 95% of the transactions occurred in cities[11]. It brought an astonishing amount of takeaway garbage.

The Chinese government is required to legislate to limit the food delivery industry's scale and then reduce the generation of solid waste[12]. However, this requirement was not adopted by the Chinese government for various reasons. Take Shenzhen, a city with a 13 million population, which has an average age of 31 as an example. The average daily working hours in this city were more than 11.5 hours in 2019[13]. In this case, most urban residents do not have enough time to cook. In the same year, the average house price in Shenzhen was ¥65516 ($CAD 13103)/ square meter[14]. Most people cannot afford a house or a spacious apartment; they live in apartment buildings with tiny kitchens. It means that most people do not have large refrigerators and the facilities to store the food that one needs to be able to cook satisfactorily. So, although many people have realized that the pollution caused by take-out garbage is unprecedented, they will still order take-out food online because of the intense pace in the city and their personal living conditions.

Legal factors leading to a surge in Chinese take-out waste In addition to the absolute increase

[9] National Bureau of Statistics of the People's Republic of China, China Internet Food Delivery Development Report (HL 2019) para 4.

[10] Ibid.

[11] Ibid.

[12] Hainan Provincial Government, *Suggestions on the development of smart city construction in Hainan Province* (HL2020) para 14.

[13] Shenzhen Statistic Bureau, *Macroeconomic operation in Shenzhen*' (2020).

[14] Ibid.

of internet food delivery, the following reasons are important factors for the surge in take-out garbage:

Weak enforcement of plastic lunch box recycling laws The environmental laws that concern the plastic take-out boxes are not be well implemented, which has led to the widespread use of non-recyclable and non-degradable plastic lunch boxes[15] in China. The "Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Wastes" (Solid Wastes Law) established the country's implementation of the extended producer responsibility system with a legal hierarchy, stipulating that if relevant enterprises use non-degradable plastic bags and other disposable plastic products in business scenarios[16], they must report to the local government departments[17]. However, this law does not stipulate what the price is for pollution by solid waste, how to take samples, or how the environmental department would count the company's data for reporting[18], which means that this is not a very enforceable law.

Since there is no uniform material selection standard in China to restrict the material of the take-out boxes, the primary factor considered by the manufacturers and restaurants will be the cost. Therefore, low-cost plastic materials have become their best choice[19]. However, these cheap raw materials have extremely poor environmental performance and are difficult

[15] Ma Jing “Who will pay for the pollution of food delivery box” (2017) 35 Industry Observation on Food Packaging 55.

[16] 2005 Environmental Conservation Law of the People's Republic of China （中华人民共和国环境保护法）(China Environmental Law).

[17] 2008 Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste (中华人民共和国固体废物防治法) (Solid Waste Law).

[18] China Environmental Law, art 7.

[19] Ma (n15) 11.

to recycle and degrade naturally.

Furthermore, the penalties for violation of those obligations are too low to restrict the business behaviour and habits of the enterprise: "for violations of the mandatory standards for excessive packaging, the market supervision and management department of the local people's government shall order corrections[20]; if the enterprise refuses to make corrections, a fine of not less than ¥2,000 CNY ($CAD 400) but not more than ¥2,0000 CNY ($CAD 4000) shall be imposed[21]. Compared with the huge profits of the catering and food delivery industries, the cost of violating this environmental protection law is extremely low, and it is not enough to urge plastic tableware manufacturers and restaurants to change their business behaviour. In order to show service and satisfy customers, a large number of restaurants over-package and give tableware far exceeding the number of diners[22].

Lack of legislative subsidies for take-out meal box recycling According to the Solid Waste Law, there are no subsidies for take-out food box recycling. The price of a new foam lunch box is extremely cheap[23], maybe 1/3 of the recyclable ones; therefore, no recycling companies are willing to spend time recycling the food box waste. This is also the essential factor that raises China's difficulty building professional take-out box solid waste recycling centres[24]. Since there is no financial subsidy, people and corporations have little interest in the recycling of take-out food box garbage.[25]

[20] Solid Waste Law, art 2.

[21] Ibid.

[22] Meituan Group: Deconstruction of takeout new formats to reshape growth (1st Edition Beijing: Electronic industry Press, 2019).

[23] Ibid 121.

[24] Ibid 10-15.

[25] Ibid 11-12.

Lacking efficient administrative supervision Some local administrative departments have made some groundbreaking attempts to regulate the waste of tableware in the take-out industry by promoting an implementation standard of social co-governance commitment. These attempts have often failed due to the lack of proper administrative monitoring.

In 2018, the Shanghai Municipal Bureau of Quality Supervision released the country's first group standard for take-out lunch boxes[26]. The new commitment aimed at reducing plastic waste by more than 75%[27]. The implementation rate after the release of the new regulations is less than 10%[28]. The reason is that this group standard is not a national compulsory standard[29].

In summary, the surge in China's take-out waste is caused by various variables. China's big cities have a large population of young people who have adopted the fast-paced life and long working hours. Most of them live in the apartments that not suitable for daily cooking. These young groups are the main consumers of Chinese take-out food platforms; their food delivery consumption is essentially inevitable. Of course, China's incomplete solid waste law and the lack of statutory recycling subsidies also take a share of the credit.

PART 2. THE GERMAN PACKAGING ORDINANCE (VERPACKG) CASE STUDY OF PACKAGING WASTE DISPOSAL LEGISLATION AND INSPIRATION FOR CHINA'S TAKEAWAY FOOD PACKAGING LEGISLATION

German packaging ordinance: General overview Across the world's various legislation and treatment methods for packaging waste, the German Packaging Act stands out as a

[26] Shanghai Quality Supervision Bureau, Shanghai Network Food Delivery Packaging Group Standards (2018).

[27] Ibid 11.

[28] Ibid 6.

[29] Zhang Fengyi, 'The recycling obligation of 'takeaway waste' should be clarified by legislation' (2016), 134 Study on flower border protection and circular economy LJ 42.

distinguished one[30]. Whether it is the scientific nature of the legislation or its implementation, it can be used as a reference for China to improve the legislation and supervise the producer's extended responsibility system. The best part of this law is that it regulates every aspect of solid waste generation and recycling; therefore, it firmly controls all of the various variables of solid waste generation and recycling.

In the interest of stemming the rising tide of packaging, Germany enacted the Packaging Ordinance in 1991; it adopted the principle of producer's responsibility and allocated the recycling responsibility to the producers and distributors of the products[31]. It also provides two ways of recycling for manufacturers and distributors:1) Manufacturers recycle product packaging waste through their wholesale and retail channels[32]; 2) Establish a private system nationwide to collect, sort and recycle[33].

With the enactment of the Packaging Ordinance, related manufacturers and distributors have spontaneously organized together to establish a non-profit organization: "Dual Disposal System"[34]. In its early days, the task of this NGO was to organize recycling, sorting, processing, and reuse of packaging waste; the purpose was to enjoy the tax exemption policy of the Packaging Ordinance [35]. It is a management platform that operates in parallel with the existing public waste recycling system in Germany. Green Dot's income source was the license fee for

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[30] Mathias Elspaß and Felix Feldmann, 'Environmental law and practice in Germany' (2020), Thomson Reuters Practical Law <https://ca.practicallaw.thomsonreuters.com/4-5030486?__lrTS=20210130041754368&transitionType=Default&contextData=(sc.Default)&firstPage=true> accessed May 3 2021.

[31] 1991 German Packaging Ordinance (Verpackungsverordnung) (German Packaging Ordinance 1991).

[32] German Packaging Ordinance 1991, art 2

[33] Ibid.

[34] Su Wanjiang, 'The foreign experience of packaging waste treatment in China' (2020) 03 Journal of China Legal View 81.

[35] Neumayer, Eric 'German packaging waste management: A successful voluntary agreement with less successful environmental effects' (2000) European Environment 152-163.

the "Green Dot " trademark[36]. The fee for the trademark is calculated based on the packaging material, weight and quantity[37]. The license fee composition considers the actual processing costs of each type of packaging material, which all state governments supervised[38]. Green Dot must submit a quantity flow certificate to the state government every year, which proves that the company has completed the recycling amount for each packaging material stipulated in the Packaging Ordinance. Germans have very secure systems for submitting these types of certificates to ensure no cheating of the system. Their system ensures no certificates can be used more than once.

On 1 January 2019, *VerpackG* (Germany Packaging Act) came into force, replacing the Packaging Ordinance. It has new, more ambitious recycling rates and extra regulations designed for fairer and more transparent economic competition[39]. As packaging and repackaging typically accumulates with private consumers, packaging producers and distributors must participate financially in one or several schemes (Duale System) to ensure the collection and recovery of the packaging on a full coverage basis[40]. Those producers also need to register with the Central Agency Packaging Register before they can place any packaging on the market[41]. To provide full transparency about the full coverage participation in a dual system, all producers and dual systems must report their total packaging masses, materials, participation periods and company names to the Central Agency Packaging Register. Should there be violations of the new law, the federal states may impose administrative fines[42].

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[36] Ibid.

[37] Ibid.

[38] German Packaging Ordinance 1991.

[39] Kumar Parul, 'Moving towards stronger packaging waste legislation in Germany: An analysis of the German Packaging Act' (2020) IASS PolIcy Brief 13.

[40] Ibid 11.

[41] Wiesmeth, Hans, Packaging waste in a circular economy (Sincedirect 2021).

[42] Ibid.

Germany packaging act's inspiration for China's takeaway food packaging legislation China's take-out food box waste recycling is not systematic due to various factors, in contrast, the most commendable part of the German Packaging Act is to supervise every process of packaging waste. Thus, from production to recycling, the law firmly controls all of the various variables in the process. Through the case study of the German Packaging Act, there are three points that China's takeout food packaging legislation should learn from:

China should build a take-out package's production, use and recycling system (like dual system in Germany) Although China claims that they have established an extended producer responsibility system the solid waste law did not allocate the recycling responsibility to the producers and distributors of the products. At this point, the recycling responsibility allocation in the German Packaging Act can be used for reference，because this regime means that the producers bear the responsibility for recycling. Specifically, China's solid waste law should build a "dual system" as well. The Chinese government should appoint or set up some companies which are responsible for performing all necessary processes to ensure environmentally friendly waste management in this system, that is to be responsible for the collection and recycling of packaging waste. Just like in Germany, the community municipality would be responsible for the collection of domestic waste, and the system company would be responsible for packaging the waste (yellow trash can/garbage bag). These companies would issue the packaging license for businesses that are placing packaging material onto the Chinese market by selling packaged goods and control the solid waste from the source.

In German system, producers and retailers are free to choose any provider that is officially

a dual system or has a contract with a dual system[43]. As long as the customer of a company is in Germany, or anyone staying in Germany will receive its sales (packaged) items, this company or the producer of that item must registered and licensed[44]. Otherwise, the company's products will not be allowed to be sold in Germany and the company may have to pay a fine of up to 200,000[45].

For China, it is feasible for this regime to manage take-out packaging waste. First of all, the Solid Waste Law should establish or appoint several providers in different provinces, or in different categories of take-out packaging materials, stipulating that take-out packaging manufacturers and take-out catering companies should directly sign contracts with these providers, register relevant information, accept, monitor and obtain permits. In this way, the production materials of take-out packaging and the overall quantity of it can be controlled.

In this system，the price for the packaging license depends on the types of packaging materials being used as well as their quantities. The Chinese government should give low licenses prices to factories and restaurants that produce and use biodegradable materials, while imposing very high prices on licenses for factories that produce non-recyclable plastic lunch boxes. In this way, even if the production cost and raw material cost are low, manufacturers need to pay more environmental protection costs (license fees) to the providers in the system. This can achieve two effects: first, the polluter pays principle is practiced, and the polluters pay more to protect the environment than others; second, it will promote the conversion of mainstream Chinese takeaway packaging from non-recyclable to recyclable. If companies and restaurants could be guided by appropriate policies and the overall production/use costs are not far apart, there will be more lunch box manufacturers and

[43] 2019 Germany Packaging Act (VerpackG).

[44] Ibid.

[45] Ibid.

restaurants who will choose to produce or use environmentally friendly packages, which solves the problem of the surge in take-out garbage from its source.

The Chinese government should set up a central data base (like ZSVR) to monitor the use of take-out food box and waste recycling To prevent packaging waste in the first place, the producers were regulated by the Packaging Act to take producer responsibility for the packaging and reuse or recycle of the package. The Central Agency Packaging Register – ZSVR was introduced to the new Package Act in Germany, which takes the task of registering those bearing producer responsibility, making them public[46], and fostering transparency and legal certainty through its other activities such as data reporting[47]. The ZSVR monitors further ecological objectives, such as compliance with recycling quotas and the financial support to promote more sustainable packaging as well.[48] It is easy to say that such an information exchange and publishing center should be established in China also. However, the practical problem is that there are 34 provincial administrative regions in China, and each province has different local management regulations for the standards of take-out packaging, and each province has different definitions of further ecological objectives. Therefore, in such an administrative system, it is unrealistic to build such an information center in one step. The good thing is China's take-out market is dominated by three big companies which have formed a monopoly[49]. This situation is conducive to reaching an agreement on the use and recycling standards of external packaging within the food delivery industry. So, the Chinese government

[46] Ibid.

[47] Ibid.

[48] Bailey, Patricia, Packaging Law Europe (1st Edition London Routledge 2019).

[49] Sheng Gang, 'An analysis of China's packaging industry' (2017) Southwest University of Political Science and Law Working paper 17/2017.

should encourage the three primary internet take-out platforms fund a Central Agency Packaging Register center specifically for take-out packaging.

This center should also contain two fundamental functions: monitoring the use of the take-out food package boxes—making sure the restaurants use recyclable or degradable boxes instead of non-recyclable ones and ensure that the take-out waste has a suitable recycling route and make this information public. Simultaneously, this center could monitor further ecological indicates, such as compliance with recycling quotas and the financial support to promote more sustainable packaging.

This program would promote the healthy and sustainable development of the packaging industry and takeaway industry and provide experience for the establishment of third-party waste disposal agencies in China.

The Chinese government should adopt taxes and subsidies for the recycling of take-out meal boxes The two fundamental reasons that no one wants to recycle China's take-out package box waste are the low retail price of new boxes and the complicated cleaning and recycling procedures[50]. The Chinese government has not given any subsidies for the recycling of take-out food packaging[51]. What is different is that the German governance system pays great attention to cultivating the recycling awareness of costumers. According to the German package act, consumers will gain a subsidy for recycling clean plastic packaging[52], e.g. A beer bottle can be exchanged for 0.5 Euros in a recycling machine. Over time, the public has formed the environmentally friendly habit of cleaning and recycling packaging. Cultivating the Chinese

[50] Guo Yan: Investigation report on current situation of packaging recycling in main cities of China, （1st Edition，Nanning：Chemical Industry Press, 2018).

[51] Ibid 271.

[52] German Packaging Ordinance 1991.

people's habit of cleaning and recycling takeaway food packaging will also require early government subsidies. Of course, subsidies for recycling companies are even more important. Under the Verpackungsverordnung, all German companies participating in the SDS Alliance are exempted from business tax due to environmental protection, which is a big incentive for companies[53]. The Chinese government could make tax reduction and exemption policies to encourage individuals and companies to participate in the recycling industry.

To sum up, China needs to adopt policies and legislation to clarify and refine the responsibilities of polluters due to the solid waste pollution caused by the huge amount of takeaway food consumed in the cities. The most important thing is that the central government needs to designate companies and takeaway platforms to establish a particular recycling system for take-out food packaging waste. Besides, subsidies to individuals and recycling enterprises are necessary.

Through the analysis above, to solve the pollution caused by take-out packaging by improving the legislation has become a consensus; how to implement it is still controversial. To this end, many local governments and scholars have proposed a smart city program, that is, using smart city technology to restrict the use of plastic tableware and monitor the recycling of take-out tableware.

PART 3. DEFINING THE SMART CITY: INTRODUCTION TO CHINA'S SMART CITY POLICIES AND LEGISLATION ON ENVIRONMENTAL MANAGEMENT

Smart city defined: General overview A smart city is an urban development that utilizes various methods, including electronic sensors, to collect data. Data is collected from citizens, devices,

[53] Bailey, Patricia (n 48) 132.

buildings and a wide variety of assets[54]. The data is then processed and analyzed and the knowledge extracted from it is used to efficiently manage its services, assets, resources and environment. This includes real time monitoring and management of traffic and transportation systems, power plants, utilities, waste, crime detection, information systems, schools, libraries, hospitals, and other all community services.

The smart environment is a concept that first emerged in the early 1990s where city residents continuously interact with objects and sensors with an aim to improve their quality of life. It means an ecosystem of interacting objects with sensors, devices, appliances that have the capability to self-organize, to provide services and manipulate/publish complex data[55]. In recent smart city concepts and designs, the smart environment is included, eg. a smart wastewater treatment system and a smart garbage recycling system. Under this system, the sensors, actuators, displays, and computational elements, embedded in the everyday objects of people's lives, form a continuous network connecting all aspects[56].

Solving the pollution caused by take-out packaging by improving the legislation has become a consensus in China; how to implement this strategy is still controversial. To this end, many local governments and scholars have proposed a smart city[57] (smart environment) program, that is, individual cities adapt to local conditions, using smart city technology to restrict the use of plastic tableware and monitor the recycling of take-out tableware. There is no doubt that this suggestion is reasonable and practical.

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[54] <https://en.wikipedia.org/wiki/Smart_city> accessed 7 May 2021.

[55] Ibid.

[56] Ibid.

[57] Xu Rongmao, 'Proposal for the layout of new scenes online and offline' (2020) China's National People's Congress Archives.

SMART CITY LEGISLATION AND ENVIRONMENTAL PROTECTION APPLICATIONS IN CHINA China is on the leading edge of smart-city projects because the population density gives it little choice but to cope with the demands for social management which these megacities create. About half of the Smart City Projects globally are in China. Many smart cities pilot projects are underway across China addressing many infrastructure and other organizational concerns. One such organizational concern is coping with the solid waste generated in cities. Whilst the Chinese government has issued a series of policies to support smart environment programs, it still has maintained a very cautious attitude towards smart city legislation and environmental protection applications.

In terms of policies, the Ministry of Housing and Urban-Rural Development of the People's Republic of China issued the regulation on smart cities[58] in 2012. This is China's Since then, smart cities have been piloted nationwide. In 2014, the State Council issued two development plans[59] to clarify the guiding ideology, basic principles and main objectives of smart city construction[60].

The above documents are all Chinese domestic policies on smart city constructions; there are few laws and regulations on smart cities. At present, only Yinchuan, one of the first batch of smart cities in the country, issued the "Yinchuan Smart City Construction Promotion Regulations" as a bylaw in 2016.

For the smart city management of take-out package waste, only Shanghai has made an attempt. It is noticeable that this attempt did not stick to the administrative or legislative level, it tried to manage the take-out garbage problem with a mixture of smart city data and social

[58] 2017 Interim Management Measures for National Smart City Pilots（国家智慧城市试点管理暂行办法) China.

[59] 2014 National New Urbanization Plan (2014-2020)（国家新型城镇化规划 (2014-2020年) China.

[60] The State Council of People's Public of China, National New Urbanization Plan 2014-2020 (2014).

co-governance commitment.

In 2018, Shanghai's average daily takeaway orders (from the three big platforms) reached 1.65 million[61], which produced more than 1.2 billion plastic food delivery boxes per year[62],so, the Shanghai Municipal Bureau of Quality Supervision formulated a social co-governance commitment -- "Takeaway Meal Delivery Box Group Standard". The implementation of this commitment is completed by linking the order data from three major online food ordering platforms (Meituan Ele.me, and Baidu) in Shanghai and the business data from local restaurants[63], which are the essential parts of the smart city. It requires internet food delivery platforms' staff (food delivery personnel) to check the material of the take-out food's packaging, report it to the platform and see if the food packaging meets the requirements[64]. At the same time, if necessary, the takeaway platform will also take punishment measures against the restaurant[65]. This program is the first attempt to manage the take-out food garbage by a smart city system.

This social co-governance commitment also regulated that restaurant are not allowed to pass the charges for the new environmental packages onto their customers. As the restaurants must bear the extra costs, most of them were/are not happy with it. Having high-quality merchants is the essential competitiveness of internet food delivery platforms in China. To keep more quality restaurants with them, the internet food-delivery platforms tend to turn a blind eye and give those restaurants very loose requirements regarding packaging. Therefore, it is not difficult to imagine that although part of the information collection of smart cities is

[61] Yan Han: The Strategy of Take-out Food Industry (1st ed (Beijing: Electronic industry Press 2018).
[62] XU (n 6) 19.
[63] Ibid.
[64] Ibid.
[65] Ibid.

assisted, the implementation of this social co-governance commitment is very poor. The reason is that based on this commitment, the Quality Supervision Bureau has no right to supervise the food delivery platforms to fulfil this "obligation"， they have no right to punish any individuals or organizations that do not comply with the commitment either. The commitment itself did not enact any right to monitor whether businesses actually use environmentally friendly take-out packaging. Lacking the efficient supervision and punitive clauses, this regulation has become a dead issue in Shanghai.

This unsuccessful attempt shows that it is not enough to use some data from smart cities to control the pollution of take-out garbage in China. In other words, China needs to use executive means to promote environmentally friendly tableware and manage the recycling of take-out lunch boxes, assisting in the implementation of relevant environmental laws. The enforcement of policies and laws is generally high in China, so it is particularly important to discuss the legal governance of smart cities.

PART 4. CONTROL THE POLLUTION OF TAKE-OUT PACKAGING: IS THE SMART CITY THE ANSWER?

Many experts have proposed that the government deal with the soaring waste of take-out boxes by using smart city programs in China. But are smart cities the answer? Can smart cities be used to aid environmental legislation to control the variables that have caused China's huge take-out waste generation and recycling problems? In the absence of any precedent, how should China look for this answer? In China, the construction of smart cities is divided into four major sections: top-level design, smart applications, infrastructure construction and guarantee mechanisms[66]. Therefore, this paper will examine China's environmental

[66] State Administration of Market Supervision and Administration of People's public of China, National standards of People's Republic of China (GB/T 36333—2018) Smart city top-level design guide <http://www.cbdio.com/image/site2/20180730/f4285315404f1cc906b957.pdf > accessed 1 May 2021.

governance of smart cities from the following three aspects:

The legal governance structure design in the top-level design[67].

The legal governance of information used in smart applications[68].

The public participation mechanism in smart cities[69].

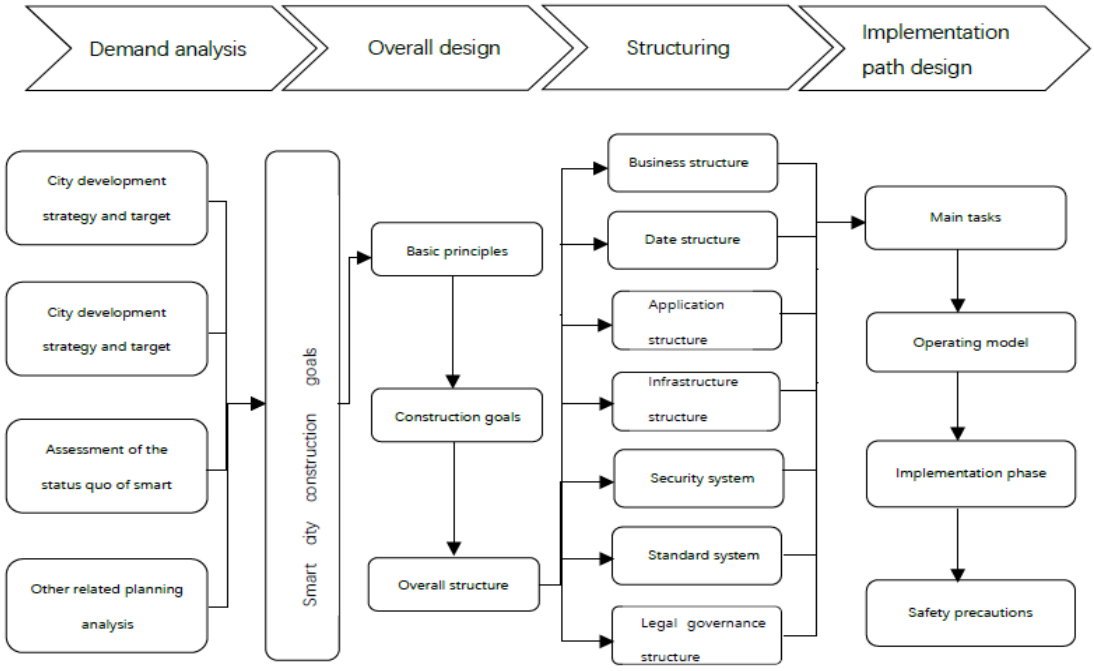

Figure 1. The basic process of smart city top-level design (adapted by the Author).[70]

The legal governance in the top-level design of a smart city The top-level design of a smart city refers a procedure that starting from the needs of urban development, uses systematic engineering methods to coordinate the various elements of the city, carry out smart city demand analysis, and make overall planning and design of smart city construction goals,

[67] Ibid 3.

[68] Ibid 7.

[69] Ibid 8.

[70] Ibid.

overall framework, construction content, and implementation paths. From this perspective, there are three aspects that the Chinese government should pay attention to.

First of all, the Chinese government should increase the attention given to environmental issues in the top-level design of smart cities and incorporate takeaway waste management into the basic needs analysis to realize the legal management of takeaway waste in the overall design as well as the architectural design. As analyzed in the second part of this paper, the German packaging ordinance provides some extremely beneficial references for China's future takeaway food packaging legislation, such as the central registration system and technological measures to monitor the take-out food packaging and government subsidy policies for take-out garbage. The combination of technologies and environmental laws cannot be achieved quickly, just as the German packaging Act has gone through 30 years of changes before it was optimised. Although it may also take a long time to change environmental legislation in China, if the top-level design of a smart city could be planned based on the predicament of urban take-out garbage and environmental laws, its management efficiency may surprise us.

Unlike other types of design, the top-level design of a smart city is not a simple outline design but more like a dynamic feedback process[71]. The basic process of top-level design can be divided into four categories: demand analysis, overall design, structuring, and implementation path design[72].

Firstly, to manage urban take-out waste, the top-level designers of smart city must incorporate this goal into the demand analysis of smart city management, seek a high degree of cooperation and support for solid waste issues from the administrative legislation and

[71] Ma Ligang, 'Waste Recovery Design for Smart Environments' (2020) Xinjiang University Working paper 8/2020.

[72] McBride, Keally: Sharing Cities: a Case for Truly Smart and Sustainable (1st ed, MIT Press, 2015).

policies[73]. This means that the top-level design of a smart city needs to clarify the value of urban takeaway waste management and manage the relationship between this part other goals.

Based on past experience, the reason that China's smart cities did not develop efficiently was usually not because of technical difficulties but because of the unreasonable target design[74]. Looking at the top-level design of many smart cities in China, the focus on the environment tends to be narrow; most of them focus on pollution control (water and air). So far, no smart city includes the design of a waste recycling system in the overall design framework. Only a few smart cities mention legal governance in the overall structure of the top-level design[75]; legal governance is definitely one of the most critical aspects of smart environmental protection[76].

On the one hand, China is a country with very strong administrative power. The driving force of policies on certain social behaviours is more direct and efficient than laws and regulations[77]. Therefore, if the environmental protection principle and the polluter pays principle can be written into the basic principles of the overall design of smart cities, this will

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[73] Li Zonghuan, 'On the construction of reflexive method in the treatment of packaging waste', Sichuan University Working Paper 1/ 2019.

[74] Sun Chuanguo, 'Exploration of smart environmental protection under the background of smart cities', (2019) Vol.38, No.7 China Resources Comprehensive Utilization <https://kns.cnki.net/kcms/detail/detail.aspx?dbcode=CJFD&dbname=CJFDLAST2019&filename=ZNCS201922073&v=VBpF79IqfA7%25mmd2F4Ovowtas5zh%25mmd2FDCaGT3jnzEVdUfqQWjOOFKOdrFb3hiO5mJADawX0> accessed May 22 2021.

[75] Yousif El-Ghalayini and Hammam Al-Kandari, 'Big Data Regulatory Legislation Security, Privacy and Smart City Governance' (2020) Pol'y & Globalization 19.

[76] Margarita Angelidou, 'Four European Smart City Strategies' (2016) Int'l J Soc Sci Stud 181.

[77] Huang Hui, 'Analysis About the New Ways Of Administrative Rule Of Law To City Construction' (2011) Juridical Science Journal10/01< https://kns.cnki.net/kcms/detail/detail.aspx?dbcode=CJFD&dbname=CJFD2011&filename=FXAS201110032&v=JX%25mmd2FtknFwwNgJ5HGx1Xd%25mmd2Bb%25mmd2FTGq%25mmd2BWu%25mmd2Fk8fRujhCpPhN%25mmd2Bcxqc%25mmd2BXHo6%25mmd2BJco7kBZFh9wB> accessed May 1 2021.

lay a good foundation for smart cities to manage the pollution from take-out garbage. With these principles as support, joining the waste management and waste recycling sections into the structuring processes becomes natural.

On the other hand, the goal of the overall design is to discuss a reasonable overall architecture, which will be expanded into a specific structure in the next process of architecture design[78]. As mentioned above, many cities try to manage their take-out garbage through local legislation. However, they have little effect because of the poor enforcement of the law. To make up for this shortcoming and give full play to the purpose of smart city assisting laws to govern the city, the overall design framework of a smart city should include the relationship between the framework itself and the relevant departmental laws governing it and even the basic national laws[79], such as the constitution.

Specific to the control of urban take-out boxes, there are two aspects that the overall design of a smart city should pay special respect to:

The first one is that the top design of smart city should incorporate the Environmental Law and Solid Waste Law into the design category. If China starts to subsidize the recycling of take-out boxes, then this subsidy policy should also be taken into consideration. Combining applicable laws and regulations with smart city technologies, finding a balance point for structure design is one of the key factors for the good operation of smart cities[80].

The second one is: considering that a large amount of personal information of citizens and businesses will inevitably be collected and used under the specific structure of a smart city[81],

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[78] State Administration of Market Supervision and Administration of China (n 66) 8.

[79] Zhu Hongjie, 'Research on Green Packaging Legal System' (2019) <https://cdmd.cnki.com.cn/Article/CDMD-10602-1019847468.htm) access 1 Jan 2021.

[80] Ibid.

[81] Jiao Lifan, 'Research on the smart city construction and government management problems in China', (2015) <https://cdmd.cnki.com.cn/Article/CDMD-10703-1015995287.htm> accessed 1 May 2021.

the overall structure of a smart city should include the legal governance design for the smart city itself[82]. This legal governance includes a consciousness of both restrictive and legal use of smart city technologies and information, which is the foundation of the legitimacy of smart cities.

Secondly, the Chinese government should build a clear legal framework for the structuring of smart cities. The application architecture, data architecture, and infrastructure architecture in the top-level design of smart cities are often given the most importance[83]. Still, most smart city projects ignore the legal governance structure[84]. It is precisely because of the lack of a proper legal governance structure that leads to some smart cities' failure and the subsequent crisis of trust[85].

The legal governance structure of a smart city should include two aspects. On the one hand, the top-level design of smart cities should ensure that the application architecture and data structure in the smart city architecture are set in compliance with the relevant departmental laws and administrative regulations, as well as the laws and regulations restricted to the smart city itself[86], to ensure that the specific structures of smart cities are legally based and will not lead to abuse of administrative power or any violation of human rights[87]. On the other hand, the top-level design of smart cities should pay attention to the laws and regulations related to its governance objectives. Specific to the management of urban take-

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[82] Tuba Bakici, Almirall & Jonathan Wareham. A Smart City Initiative: the Case of Barcelona 2013 Journal of the Knowledge Economy, LJ4-7.

[83] Ma (n 71) 6.

[84] Ibid.

[85] Tong Hang, Feng Yuan, 'Legal governance of smart cities: problems, status quo and prospects', (2018) <https://core.ac.uk/download/pdf/41436208.pdf> accessed 7 June 2021.

[86] Margarita Angelidou, 'Four European Smart City Strategies' (2016) 4 Int'l J Soc Sci Stud 18.

[87] Robert Brauneis and Ellen P Goodman, 'Algorithmic Transparency for the Smart City' (2018) 20 Yale JL & Tech 103.

out waste, if a smart city incorporates this into one of its environmental governance goals, then in its structuring, each layer of architecture, such as data structure, infrastructure structure, application structure, etc. should be designed with reference to the Environmental Conservation Law and the Solid Waste Law. It is undeniable that these environmental laws are not perfect, they still need to be improved, this could be achieved by taking references from the German packaging law. However, it is important for smart cities to plan a proper legal governance into their top-level designs. Many advanced concepts and experiences that China's current laws fail to address, could be expressed through a smart city's legal governance structure[88]. Establishing a supervision system for the usage and recycling of take-out packaging is the top priority of the Chinese government in this section, which will not only ensure the effective implementation of relevant environmental protection laws and regulations[89], solving the problem of the lack of law enforcement in China's related take-out waste management[90] but also provide experience and suggestions for the revision of environmental laws in the future.

Again, the top-level design of a smart city is more like a dynamic feedback process rather than an outline design, therefore, its influence on the environment and city solid waste management will appear gradually in the procedure.

In a word, legal governance should be given the most importance in the top-design of smart cities.

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[88] Anthopoulos, Leonidas. Smart City Emergence. San Diego: Elsevier (2019).

[89] Tong Hang, Feng Yuan, (n 85) 12.

[90] Liao Lifan, 'Research on the smart city construction and government management problems in China' (2015) CNKI <https://cdmd.cnki.com.cn/Article/CDMD-10703-1015995287.htm> accessed Sep 1 2020.

Legal governance in smart applications The legal governance for the smart applications is one of the most essential governance policies in smart cities[91]. Smart applications are a key component of a smart city, and the implementation of smart city supervision and the governance of the city mainly depends on various smart applications. Information is the core content of smart applications[92]. The core application technologies of smart cities such as the Internet of Things and cloud computing are all based on information[93]. Therefore, the definition and governance of the information that smart applications will contact, collect and use are the most important and top priorities for achieving smart city legal governance[94].

Regarding the prevention and control of the pollution of take-out packaging boxes, the legal governance of a smart city should focus on two sections: The first one is the legal definition of information-what type of information should be included in the scope of supervision of the smart environment. The second one is the use of information, which means that the Chinese government should draw a clear boundary between information disclosure and the protection of business secrets and personal privacy.

A clear distinction between information disclosure and personal privacy can provide theoretical support for information protection in the legal governance of smart cities[95]. In this way, the top-level design and specific operation of the legal governance of smart cities will be promoted.

Smart environment applications of takeaway waste disposal solutions include:

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[91] Ibid.

[92] Komninos, Nicos, 'The architecture of intelligent cities: Integrating human, collective and artificial intelligence to enhance knowledge and innovation' (IET Conference Publications, July 2016).

[93] Ibid,

[94] Anthopoulos (n 88) 129.

[95] Wang Zhenning, 'Study on the Legal Regulation of Green Takeaway Packaging in China', (2015) CNKI <https://cdmd.cnki.com.cn/Article/CDMD-10742-1019073559.htm> accessed 1 July 2021.

establishing a unified environmental intelligent perception system and an Internet of Things network; comprehensively sensing and monitoring the whole process of the production, purchase and use of plastic lunch boxes in the entire domain[96]; establishing an "environmental cloud" data centre[97], integrating the transaction data of different take-out platforms and the use of disposable tableware; establishing environmental protection application systems such as monitoring, supervision, and the use of intelligent terminals to monitor the use of take-out tableware in different catering industries and the status of residents' garbage recycling[98]; establishing an intelligent environmental protection information release system and so on. In the process of these applications, what specific personal and commercial information can be accessed and collected by the government and agencies, whether this information can be used as the basis for administrative law enforcement are the issues that Chinese government and policy makers must publicize and clarify with laws or regulations[99][100].

In other words, in the process of using smart city applications, the public need to have certainty, to understand where the boundaries of these smart applications are. They have the right to know what behaviors, or where their behaviors will be monitored, and they also have the right to know what kind of information will be collected and used. This certainty may bring some restrictions to the management of take-out garbage in smart cities; however, it can protect citizens' right to know and human rights. Due to scope limitations, this paper will not discuss the human rights issues of smart cities here.

[96] Ibid 12.

[97] Ibid 55-1.

[98] Ibid 23.

[99] Jiao (n 81) 3.

[100] Jiao (n 81) 3.

The rule of public participation in the safeguarding of smart cities To design a functional smart city, the Chinese government brings several kinds of guaranteed measures into it, such as funds, human resources, systems and policies[101]. Public participation is one of the most direct and powerful guarantees for the operation of smart cities[102]. In dealing with the explosion of take-out garbage, the Chinese government should focus on the following three aspects to involve the public in the supervision of smart cities:

System design of information acquisition channels The system that decides how much and what kind of information would open to the public is critical for environmental protection[103]. The right to know is the prerequisite for public participation and supervision[104]. The prerequisite for bringing the pollution of take-out meal boxes into the scope of smart city governance is information disclosure. The Chinese government should design information acquisition channels for smart city programs. In the context of smart cities, the channels for the public to obtain information have become extensive and numerous, what information should be disclosed to the public is the current problem[105].

In the case of takeaway garbage treatment in smart cities, the following information should be released to the public: technology and quality standards of the takeaway packaging boxes, to what extent the government will use the data collected from cameras in public areas and take-out platforms, how urban residents should recycle take-out garbage, and to what

[101] State Administration of Market Supervision and Administration of China (n 66) 79.

[102] Jiao (n 81) 56.

[103] Petra Durman, 'Participation in Public Administration Revisited: Delimiting, Categorizing and Evaluating Administrative Participation' (2020) 20 Croat & Comp Pub Admin 79.

[104] Li Ainian, 'Environmental Information Disclosure System in the Aarhus Convention and its enlightenment to China' (2010) 09 Hunan University Law Review 153.

[105] Jiao (n 81) 100.

extent will the personal information of citizens be collected and accessed by the government etc.

As long as the residents of these cities have sufficient access to the relevant information, they can question these standards and implementation methods, thereby supervise the management of take-out meal box waste in their smart cities[106].

Public opinion expression platform design One of the necessary conditions of supervision is that the public has the opportunity and channels to express their opinions[107]. The level of public participation in environmental protection in China is low [108]. This does not mean that the Chinese government did not pay attention to public participation. All environmental protection organizations and departments have set up opinion centres to accept complaints from the public, some departments also collect and process those suggestions, however, few citizens are willing to express their opinions[109]. It mainly because of two reasons: the first one is, compared with most countries globally, China's administrative power is very strong, which makes the public unwilling to deal with the government[110]. Because of fear of reprisals from the executive power, Chinese people generally have concerns about expressing their opinions[111]. The second reason is, public participation, such as attending hearings, takes a lot of time. The pace of life in Chinese cities is very fast nowadays. Most urban citizens live a busy schedule, coupled with traffic problems, people are unwilling to spend time doing something that sounds largely irrelevant to their lives (such as attending environmental protection

[106] Ibid.

[107] Ibid.

[108] Abhi Nemani, 'Data & Dashboards: The Linchpin of the Smart City' (2017) 85 UMKC L Rev 973.

[109] Luo Gang, 'Public Awareness and Normative Reflection on Animal Criminal Law Protection' (2019) Xinjiang University Working paper, accessed 1 May 2021.

[110] Ibid.

[111] Ibid,

hearings).

Creating a radical change to the administrative system to increase public participation in environmental issues in China cannot be completed in a short period[112]. But smart cities have the potential to increase the possibility of public participation. The Chinese government could rely on the foundation of smart cities to establish a wide-ranging public opinion expression mechanism, designing online polls or online voting on environmental platforms or garbage recycling platforms[113]. This would create a speedy and efficient yet indirect way for the public to speak out with their opinions and experiences[114]. On those smart city platforms, the public do not have to go to specific administrative agencies and deal with government officials face to face, they can sit in their offices or homes to type their ideas. This would also significantly reduce the psychological burden on the public[115] and make them much more willing state their opinions. At the same time, it does not require people travel to a physical location, which will also save time for the public therefore allowing more people to participate in public decision-making.

[112] Yousif El-Ghalayini and Hammam Al-Kandari, 'Big Data Regulatory Legislation:Security, Privacy and Smart City Governance' (2020) 95 JL Pol'y & Globalization 19.

[113] Ibid.

[114] Wen Duren 'Research on the path of Chinese public participation in social Management' (2005) 07 China Legal Science 140.

[115] Ibid.

Public participation mechanism design Public participation is an effective measure to raise public awareness[116]. When the public participates in the decision-making process of restricting the use and recycling of plastic lunch boxes, they can intuitively understand the environmental protection projects in their smart city and put forward their own opinions, which is a method to supervise the government and other smart city projects. The public is an essential player in the recycling of take-out lunch boxes[117].

In all of the environmental legislation in China, except the Environmental Protection Law (2014) which stated the principle of public participation, there are no specific provisions to guide the public on participating in environmental assessment and solid waste prevention either[118]. If we want the public to consciously protect the urban environment, people must have the opportunity to see[119] how much take-out waste is produced per day and to know the options for how we can process it.

It takes a long time to process legislation to increase public participation in the environmental issues but setting up a mechanism for public participation in the environmental management of a smart city is quite convenient, and it does not require legislation. It can be easily achieved through technology. The Chinese government should set up an anonymous questionnaire platform and an anonymous information feedback platform, encourage people in different regions to reflect on the difficulty of handling take-out garbage through the internet or other accessible channels[120]. Citizens should be allowed to vote on the Internet to participate

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[116] Tong Hang, Feng Yuan, (n 85) 3.

[117] Cui Qinhong, Liu Xiao and Wu Dandan, 'Research on Participatory Governance Model of the Construction of Smart City, (2017) Technology and Application Law 187.

[118] Cai Fuyue, 'Research on Public Participation in Environmental Protection' (2018) Liaoning University Working paper, accessed 1 May 2021.

[119] Ibid.

[120] Guangdong Provincial government, '*Guangdong Provincial government regulations on strengthening public participation in reducing wildlife trafficking*' (2014) para 53.

in the process of determining the cost of take-out recovery subsidies as well[121]. Setting up public participation through smart cities is simple and low-cost, but they can implant the concepts of reducing take-out waste and other environmental concept into the public's consciousness, which is an effective environmental protection measure.

In summary, above three further methods of research will provide a framework of support for the legal governance of smart cities and become the legal basis of managing urban take-out packaging waste by smart cities. At the same time, these are essential facts that cannot be ignored in the environmental governance of smart cities in China.

CONCLUSION

In recent years, China's food delivery industry has become overdeveloped. In the industry, the use rate of non-recyclable lunch boxes is very high and most restaurants do not want to switch to eco-friendly containers due to costs. The current Chinese environmental legislations have not achieved the goal of preventing the generation of large amounts of non-degradable garbage. At the same time, China does not have a reasonably solid waste recycling system or recycling subsidies.

This paper gives suggestions for improving China's environmental protection laws to cope with the surge in take-out package waste by studying and learning from the German Packaging Ordinance: establish a recycling system specifically for take-out packaging waste; monitor and control all possible variables in the system; and adopt taxes and subsidies for the recycling of take-out meal boxes.

While the internet food delivery industry is rapidly developing, China's smart city projects are also in full swing. The huge population density and various variables in different regions

[121] Sun (n 74) 23.

leaves China little choice. Since the environmental regulations cannot be improved immediately, China must take bold steps in terms of both technology and regulation to cope with the demands for social management, which these megacities create. Smart city become a reasonable choice.

This paper analyses the smart city legislation and environmental applications in China. It also starts from the structure of the smart city, examines how the top-level design, information utilization design, and supervision mechanisms design could effectively support smart city programs to regulate the use and recycling of take-out packaging containers.

Using smart cities to manage the use and recycling of take-out packaging boxes is a brand-new endeavor. Megacities in China need this desperately; the experience gained from this attempt will help China deal with environmental problems and can be used as a reference for other big cities in the world. As the degree of urbanization increases, the pollution of take-out packaging boxes will become a common problem in cities worldwide. The environmental conditions, legislative conditions and takeaway consumption conditions of each city are different, addressing take-out packaging through legislation may need a long time. Still, the advantage of a smart city is that it can assist the implementation of environmental legislation and monitor and deal with the various variables in environmental issues before the legislation. China's experiences may provide a new path for the city's solid waste disposal and other environmental problems and lead the cities to explore more environmental protection possibilities.